

Remarks

A. Pending Claims

Claims 1691-1747 are pending.

B. The Claims Are Not Obvious Over Eastlund et al. In View of Rose Pursuant To 35 U.S.C. §103(a)

Claims 1691-1697, 1699-1717, and 1719-1747 were rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 4,716,960 to Eastlund et al. (hereinafter "Eastlund") in view of European Patent Application 0130671 to Rose (hereinafter "Rose"). Applicant respectfully disagrees with these rejections.

To reject a claim as obvious, the Examiner has the burden of establishing a *prima facie* case of obviousness. *In re Warner et al.*, 379 F.2d 1011, 154 U.S.P.Q. 173, 177-178 (C.C.P.A. 1967). To establish *prima facie* obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. *In re Royka*, 490 F.2d 981, 180 U.S.P.Q. 580 (C.C.P.A. 1974), MPEP § 2143.03.

Claims 1691 and 1711 describe combinations of features including:

one or more electrical conductors located in the heater well and extending from the surface into the hydrocarbon containing layer, the electrical conductors being electrically coupled to the AC supply;

at least one electrical conductor comprising one or more ferromagnetic sections, and being configured to provide an electrically resistive heat output during application of AC to the electrical conductor such that heat transfers from the electrical conductor to hydrocarbons in the hydrocarbon containing layer to at least mobilize some hydrocarbons in the layer.

Claim 1731 describes a combination of features including:

providing an AC at a voltage above about 200 volts to one or more electrical conductors located in a heater well extending from a surface of the earth into a hydrocarbon containing layer in the formation, ...

allowing heat to transfer from the electrical conductors to hydrocarbons in the hydrocarbon containing layer to at least mobilize some hydrocarbons in the layer.

The cited art does not appear to teach or suggest the combination of features set forth in the system claims including, but not limited to:

“one or more electrical conductors located in the heater well and extending from the surface into the hydrocarbon containing layer, the electrical conductors being electrically coupled to the AC supply;” and

“at least one electrical conductor comprising one or more ferromagnetic sections, and being configured to provide an electrically resistive heat output during application of AC to the electrical conductor such that heat transfers from the electrical conductor to hydrocarbons in the hydrocarbon containing layer to at least mobilize some hydrocarbons in the layer.”

The cited art does not appear to teach or suggest the combination of features set forth in the method claims including, but not limited to:

“providing an AC at a voltage above about 200 volts to one or more electrical conductors located in a heater well extending from a surface of the earth into a hydrocarbon containing layer in the formation;” and

“allowing heat to transfer from the electrical conductors to hydrocarbons in the hydrocarbon containing layer to at least mobilize some hydrocarbons in the layer.”

Eastlund does not teach any of the above-mentioned combinations of features. Significantly, Eastlund teaches away from the combination of features in Applicant’s claims. While Eastlund does refer to heaters below the ground in petroleum producing wells, these heaters are not used to transfer heat into any portion of any hydrocarbon containing layer and no reference is made to the heaters extending into any hydrocarbon containing layer. Rather, the heaters of Eastlund are used to prevent solids formation in the wellbores during petroleum production. Eastlund states: “This invention relates to a method and system for introducing electric power into a petroleum well. **Power may be used to heat the tubing or drive a load such as a pump.**” (Eastlund, column 1, lines 5-8) (emphasis added). Eastlund further states: “An object of this invention is to electrically heat the tubing of a petroleum well by passing

current through the tubing **to prevent formation of solids such as paraffins.**" (Eastlund, column 1, lines 47-50) (emphasis added).

Furthermore, Eastlund teaches **low degrees of heating** that are not sufficient to mobilize any hydrocarbons in any hydrocarbon containing layer. Eastlund states: "Thus, at 200 feet, application of 5000 watts for 10.8 hours resulted in **an increase from 73 degrees to 85 degrees Fahrenheit.**" (Eastlund, column 4, lines 38-40) (emphasis added). The temperature increases shown in the table (column 4, lines 41-53) are no greater than 14 °F. These measured temperature increases were in the production wellbore itself. Any temperature increase within the formation (or any hydrocarbon containing layer in the formation) by such a heater would be **less than** the temperature increase in the wellbore. Thus, Eastlund teaches **low degrees of heating** using the disclosed heater that would not provide sufficient heat to mobilize any hydrocarbons in any hydrocarbon containing layer.

In addition, the heaters of Eastlund appear to be above any hydrocarbon layer. For example, Eastlund states: "**At the lower end of the casing perforations 12** admit fluid from the formation into the well bore." (Eastlund, column 3, lines 17-19) (emphasis added).

Applicant's claims 1691 and 1715, however, refer to the combination of features including, but not limited to "an electrical conductor located in the heater well and extending from the surface and **into the hydrocarbon containing layer**" and "application of AC to the electrical conductor such that **heat transfers from the electrical conductor to hydrocarbons in the hydrocarbon containing layer** to at least mobilize some hydrocarbons in the layer" (emphasis added). Applicant's claim 1739 refers to the combination of features including, but not limited to, "providing AC to an electrical conductor located in a heater well extending from a surface of the earth **into a hydrocarbon containing layer in the formation**" and "**allowing heat to transfer from the electrical conductors to hydrocarbons in the hydrocarbon containing layer** to at least mobilize some hydrocarbons in the layer" (emphasis added).

Rose relates to autoregulation in a "relatively small device." See page 8, line 20. There is no teaching or suggestion in Rose of any of the above-mentioned combinations of features. Rose does not, for example, even mention wells or hydrocarbons. Rose does not, for instance, have any teaching relating to "electrical conductors in a heater well and extending from the

surface into the hydrocarbon containing layer,” “voltage above about 200 volts,” and/or transferring heat from “electrical conductors to hydrocarbons in the hydrocarbon layer to at least mobilize some hydrocarbons in the layer,” in combination with the other features in Applicant’s claims.

In fact, Rose teaches away from the combinations of features in Applicant’s claims because Rose refers to heating fluids **inside** of the device. Specifically, Rose states: “It should be noted that the insulating layer 29 of Fig. 3 has been eliminated to provide a gap between return conductor 27 and ferromagnetic layer 31. This gap insulates such members from one another and may be employed to heat fluids; air, gas, water, or other liquid, for a variety of purposes. Any one of the insulating layers may be removed to accept fluid and in fact, three different fluids may be heated simultaneously to three different temperatures.” (Rose, page 17, lines 18-26). Applicant’s claims 1691 and 1711, however, refer to the combination of features including, but not limited to, “one or more electrical conductors located in the heater well and extending from the surface **into the hydrocarbon containing layer**” and “application of AC to the electrical conductor such that **heat transfers from the electrical conductor to hydrocarbons in the hydrocarbon containing layer** to at least mobilize some hydrocarbons in the layer” (emphasis added). Applicant’s claim 1731 refers to the combination of features including, but not limited to, “providing an AC at a voltage above about 200 volts to one or more electrical conductors located in a heater well extending from a surface of the earth **into a hydrocarbon containing layer in the formation**” and “**allowing heat to transfer from the electrical conductors to hydrocarbons in the hydrocarbon containing layer** to at least mobilize some hydrocarbons in the layer” (emphasis added).

Applicant submits that the combination of cited art does not appear to teach or suggest all of the features of claims 1691, 1711, 1731, and the claims dependent thereon.

Applicant submits, in addition, that some of the claims dependent on claims 1691, 1711, and 1731 are separately patentable.

Claims 1692 and 1712 describe combinations of features including: “at least one production well extending into the hydrocarbon containing layer and configured to produce at

least some of the mobilized hydrocarbons from the hydrocarbon containing layer.” The cited art does not appear to teach or suggest at least the above-quoted features of claims 1692 and 1712, in combination with the other features of the claims.

Claims 1693 and 1713 describe combinations of features including: “wherein at least one electrical conductor transfers heat during use to hydrocarbons in the hydrocarbon containing layer to at least mobilize some hydrocarbons in the layer.” The cited art does not appear to teach or suggest at least the above-quoted features of claims 1693 and 1713, in combination with the other features of the claims.

Claims 1694 and 1714 describe combinations of features including: “wherein at least one electrical conductor transfers heat during use to hydrocarbons in the hydrocarbon containing layer to pyrolyze at least some hydrocarbons in the layer.” The cited art does not appear to teach or suggest at least the above-quoted features of claims 1694 and 1714, in combination with the other features of the claims.

Claims 1695 and 1715 describe combinations of features including: “wherein at least one of the ferromagnetic sections heats during use to a temperature of at least about 650 °C.” The cited art does not appear to teach or suggest at least the above-quoted features of claims 1695 and 1715, in combination with the other features of the claims.

Claims 1696 and 1716 describe combinations of features including: “wherein the AC supply is configured to provide AC at a voltage below about 2500 volts.” The cited art does not appear to teach or suggest at least the above-quoted features of claims 1696 and 1716, in combination with the other features of the claims.

Claims 1697 and 1717 describe combinations of features including: “wherein the heater well extends from the surface of the earth through an overburden of the formation into the hydrocarbon containing layer.” The cited art does not appear to teach or suggest at least the above-quoted features of claims 1697 and 1717, in combination with the other features of the claims.

Claims 1699 and 1719 describe combinations of features including: “wherein at least one of the ferromagnetic sections comprises iron, nickel, chromium, cobalt, tungsten, or a mixture thereof.” The cited art does not appear to teach or suggest at least the above-quoted features of claims 1699 and 1719, in combination with the other features of the claims.

Claims 1700 and 1720 describe combinations of features including: “wherein at least one of the ferromagnetic sections has a thickness of at least about $\frac{3}{4}$ of a skin depth of the AC at the Curie temperature of such ferromagnetic sections.” The cited art does not appear to teach or suggest at least the above-quoted features of claims 1700 and 1720, in combination with the other features of the claims.

Claims 1701 and 1721 describe combinations of features including: “wherein the heat output below the selected temperature is greater than about 400 watts per meter of electrical conductor.” The cited art does not appear to teach or suggest at least the above-quoted features of claims 1701 and 1721, in combination with the other features of the claims.

Claims 1702 and 1722 describe combinations of features including: “wherein at least a portion of the electrical conductor is longer than about 10 m.” The cited art does not appear to teach or suggest at least the above-quoted features of claims 1702 and 1722, in combination with the other features of the claims.

Claims 1703 and 1723 describe combinations of features including: “wherein one or more of the ferromagnetic sections are configured to sharply reduce the heat output at or near the selected temperature.” The cited art does not appear to teach or suggest at least the above-quoted features of claims 1703 and 1723, in combination with the other features of the claims.

Claims 1704 and 1724 describe combinations of features including: “wherein the heat output from at least a portion of the ferromagnetic sections decreases at or near the selected temperature due to the Curie effect.” The cited art does not appear to teach or suggest at least the above-quoted features of claims 1704 and 1724, in combination with the other features of the claims.

Claims 1705 and 1725 describe combinations of features including: “wherein the AC resistance of the electrical conductor increases with an increase in temperature up to the selected temperature, and wherein the AC resistance of the electrical conductor decreases with an increase in temperature above the selected temperature.” The cited art does not appear to teach or suggest at least the above-quoted features of claims 1705 and 1725, in combination with the other features of the claims.

Claims 1706 and 1726 describe combinations of features including: “wherein the AC supply provides an electrical current of at least about 70 amps to the electrical conductor.” The

cited art does not appear to teach or suggest at least the above-quoted features of claims 1706 and 1726, in combination with the other features of the claims.

Claims 1707 and 1727 describe combinations of features including: “wherein at least one of the electrical conductors comprises a turndown ratio of at least about 2 to 1.” The cited art does not appear to teach or suggest at least the above-quoted features of claims 1707 and 1727, in combination with the other features of the claims.

Claims 1708 and 1728 describe combinations of features including: “wherein the AC supply applies AC at about 180 Hz.” The cited art does not appear to teach or suggest at least the above-quoted features of claims 1708 and 1728, in combination with the other features of the claims.

Claims 1709 and 1729 describe combinations of features including: “wherein the system withstands operating temperatures of about 250 °C or above.” The cited art does not appear to teach or suggest at least the above-quoted features of claims 1709 and 1729, in combination with the other features of the claims.

Claims 1710 and 1730 describe combinations of features including: “wherein the electrical conductor automatically provides the reduced amount of heat above or near the selected temperature.” The cited art does not appear to teach or suggest at least the above-quoted features of claims 1710 and 1730, in combination with the other features of the claims.

Claim 1732 describes a combination of features including: “producing at least some of the mobilized hydrocarbons from the layer through a production well extending into the hydrocarbon containing layer.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 1732, in combination with the other features of the claim.

Claim 1733 describes a combination of features including: “wherein the transferred heat pyrolyzes at least some hydrocarbons in the hydrocarbon containing layer.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 1733, in combination with the other features of the claim.

Claim 1734 describes a combination of features including: “producing at least some of the pyrolyzed hydrocarbons from the layer through a production well extending into the hydrocarbon containing layer.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 1734, in combination with the other features of the claim.

Claim 1735 describes a combination of features including: “wherein the heater well extends from the surface of the earth through an overburden of the formation into the hydrocarbon containing layer.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 1735, in combination with the other features of the claim.

Claim 1736 describes a combination of features including: “wherein at least one of the ferromagnetic sections heats to a temperature of at least about 650 °C.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 1736, in combination with the other features of the claim.

Claim 1737 describes a combination of features including: “providing the AC at a voltage below about 2500 volts.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 1737, in combination with the other features of the claim.

Claim 1738 describes a combination of features including: “providing the AC to at least one of the electrical conductors at or above the selected temperature.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 1738, in combination with the other features of the claim.

Claim 1739 describes a combination of features including: “providing the AC at a frequency of about 180 Hz.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 1739, in combination with the other features of the claim.

Claim 1740 describes a combination of features including: “providing an initial electrically resistive heat output when the electrical conductor providing the heat output is at least about 50 °C below the selected temperature, and automatically providing the reduced amount of heat above or near the selected temperature.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 1740, in combination with the other features of the claim.

Claim 1741 describes a combination of features including: “wherein an AC resistance of at least one of the ferromagnetic sections decreases above the selected temperature to provide the reduced amount of heat.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 1741, in combination with the other features of the claim.

Claim 1742 describes a combination of features including: “wherein at least one of the ferromagnetic sections has a thickness of at least about $\frac{3}{4}$ of a skin depth of AC at the Curie

temperature of the ferromagnetic material.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 1742, in combination with the other features of the claim.

Claim 1743 describes a combination of features including: “wherein the reduced amount of heat is less than about 400 watts per meter of length of electrical conductor.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 1743, in combination with the other features of the claim.

Claim 1744 describes a combination of features including: “controlling a skin depth in at least one of the ferromagnetic sections by controlling a frequency of the applied AC.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 1744, in combination with the other features of the claim.

Claim 1745 describes a combination of features including: “applying additional current to at least one of the ferromagnetic sections as the temperature of such ferromagnetic sections increases until the temperature is at or near the selected temperature.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 1745, in combination with the other features of the claim.

Claim 1746 describes a combination of features including: “controlling an amount of heat provided by at least one of the ferromagnetic sections by controlling an amount of current applied to at least one of the electrical conductors.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 1746, in combination with the other features of the claim.

Claim 1747 describes a combination of features including: “applying current of at least about 70 amps to at least one of the electrical conductors.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 1747, in combination with the other features of the claim.

C. The Claims Are Not Obvious Over Eastlund et al. In View of Rose And Further In View of Bridges et al. Pursuant To 35 U.S.C. §103(a)

Claims 1698 and 1718 were rejected under 35 U.S.C. §103(a) as being unpatentable over

Eastlund in view of Rose and further in view of Canadian Patent No. 2,151,521 to Bridges et al. Applicant respectfully disagrees with this rejection.

Claims 1698 and 1718 describe combinations of features including: “wherein the system comprises three or more electrical conductors, and wherein at least three of the electrical conductors are coupled in a three-phase electrical configuration.” The cited art does not appear to teach or suggest at least the above-quoted features of claims 1698 and 1718, in combination with the other features of the claims.

For at least the reasons cited above in section B of this document, Eastlund and Rose do not appear to teach, suggest, or provide motivation for the above-quoted features of the claims.

D. Provisional Double Patenting Rejections

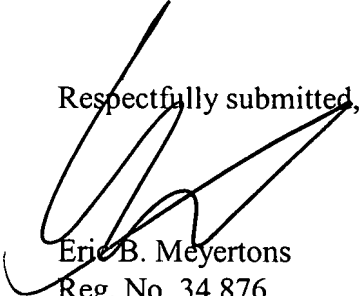
Claims 1691-1747 were provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1691-1743 of copending U.S. Pat. Appl. No. 10/693,700 or claims 1691-1753 of copending U.S. Pat. Appl. No. 10/693,840. Upon the present application being in condition for allowance but for the double patenting rejections, Applicant will provide arguments for the inappropriateness of the double patenting rejections and/or provide a terminal disclaimer.

E. Additional Comments

Applicant respectfully requests a one-month extension of time. If any additional extension of time is necessary, Applicant hereby requests the appropriate extension of time. A Fee Authorization is enclosed for the extension of time fee. If any additional fees are required or if any fees have been overpaid, please appropriately charge or credit those fees to Meyertons, Hood, Kivlin, Kowert & Goetzel, P.C. Deposit Account Number 50-1505/5659-20900/EBM.

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Appl. Ser. No.: 10/693,820
Atty. Dkt. No.: 5659-20900

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